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A Problem to Solve. (Courtesy West Allis High School)

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The Science Teacher

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America's Mineral Resources in Wartime

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IF THE reader has had little geological experience the word mineral may bring to his mind a picture of brightly colored crystals displayed in museum cases. True, these are minerals; To a geologist, a mineral is a *substance occurring in nature with a characteristic chemical composition*. This definition includes not only minerals as the amateur collector knows them (quartz and feldspar, for example) but also such diverse materials as metallic ores, coal, oil, and natural gas.

It is obvious, then, how important mineral deposits are to a nation at war. Modern war is dependent upon science to a high degree; it is waged with extremely complex weapons such as the submarine and airplane. Delicate instruments — sound-detecting devices and short wave radio — are also necessary; and for the manufacture of all these machines of war it is imperative that the belligerent nation have adequate supplies of various minerals.

ANOTHER aspect typical of modern warfare is the vast scale on which it is fought. Immense quantities of weapons must be produced, with the result that certain minerals are in much greater demand than in time of peace. Others, such as gold and silver, become relatively unimportant.

It can thus be seen that the mineral needs of a warring nation differ from those of a nation at peace. But war complicates the mineral situation even more than this, for the beginning of hostilities almost inevitably deprives the belligerants of mineral sources which had previously been available.

It is an interesting fact that no nation in the world contains within its borders all the minerals for maintenance of modern civilization. Of all the nations, the United States comes closest to self-sufficiency; but even we are lacking in certain important minerals. Before the war these were easily obtainable by trade. Since 1939, however, some of these deposits have been closed to us by conquest; others have been isolated by the difficulties of ocean transportation through submarine-infested seas; still others have proved insufficient for our wartime needs. The combination of these war-induced factors has forced all nations to take stock more than ever before of the mineral resources within their borders. Some deficiencies may be supplied by allied or neutral countries; others must be made up by devising substitutes for minerals no longer available. In a few instances, it has been possible for a government to make up shortages by exploiting low grade mineral deposits — those which, because of small size or inaccessibility, could not be worked profitably by private individuals.

Oil

AS the present Russian campaign is demonstrating, oil is a fundamental necessity of modern warfare. Germany is deficient in this mineral; she is endeavoring to acquire the rich oil fields of the Russian Caucasus.

The United States, on the other hand, is at present the leading oil producer of the world. Our volume of production is illustrated by the fact that the pipe line now being constructed from Texas to Illinois will in a month carry 9,000,000 barrels — twice the monthly production of Rumania (Germany's chief source of oil). The total oil

was 1,400,000,000 barrels, an all-time record. Second in volume of oil production has been Russia, whose 1941 yield was 238,000,000 barrels.

In August, 1942, Germany controlled oil fields which yield a total of 50,000,000 barrels yearly.. This is less than half her requirements for the prosecution of an aggressive war, and she is endeavoring to make up the deficit by construction of many plants to synthesize oil from coal.

IT is thus seen that the United States alone can produce more oil than is available to the Axis. Most of our production comes from the so-called Mid-Continent field, including Oklahome, Kansas, New Mexico, Arkansas, and parts of Texas and Louisiana; this area is the greatest oil-producing region in the world today.

Insofar as oil is concerned, then, no production problems have been raised by the war. The only difficulties which we face in regard to this product are, as everyone knows, in respect to transportation. One of our greatest wartime broblems is that of transporting oil not only to our allies beyond the oceans, but also to our own eastern seaboard.

Iron

Here again is a mineral in whose production the United States leads the world. Iron and oil together are the primary necessities of modern warfare, and the demands upon our iron resources are much greater now than in time of peace (a fact well shown by the present nation-wide search for scrap iron).

TWO iron deposits produce most of America's supply of that mineral. The first of these is the great Lake Superior district. Here, in northern Wisconsin and Minnesota and just across the border in southern Canada, are enormous deposits of high grade ore (30 to 40 per cent iron). Several factors make mining in this district a profitable undertaking: the deposits lie near the surface and can be dug out with steam shovels, thus eliminating the sinking of costly mine shafts. Secondly, the deposits are so situated that ore can be loaded directly on Great Lakes steamers, an economical means of transportation to the smelter.

Second in importance in American iron production are the deposits near Birmingham, Alabama. In the same mountains with the ore there can also be found limestone and coal, both necessary in the manufacture of steel. For this reason the Birmingham ore can be made into steel within a few miles of the mine.

AS the war progresses, the demand for steel mounts steadily, and it will, sooner or later, prove necessary to open up small deposits whose exploitation would be unprofitable in peacetime. Among these low grade deposits may be counted many which have done war service in the past: Pennsylvania, for instance, is dotted with old stone iron furnaces which smelted ore for the armies of Washington and of Grant. These deposits have, for the most part, been untouched since about 1880 because of the competition of the richer regions mentioned above.

Low grade iron deposits, however, will probably not go far toward satisfying our needs if the demand for steel continues to grow. If this stage is reached, another step open to the United States will be importation of ore from Cuba, Chile and Brazil. At present, Chile is the most important of these three. The Brazilian deposits are as yet largely undeveloped.

The Ferro-Alloy Minerals

MODERN civilization is to a great extent based upon iron and steel. Since so many articles are manufactured from steel, especially, it is only natural that one type of steel will not serve all purposes. As an example, it is obvious that the steel used in manufacturing a locomotive would not serve for making surgical instruments. In order that so many different products may be made, the process of producing *alloy* steels has been perfected.

An alloy steel contains varying percentages of other materials, whose presence gives the steel the quality desired, such as toughness, hardness, or elasticity. The minerals used in making alloys of this sort are known as the *ferro-alloy minerals*. Only small quantities

of these are necessary, but a supply of them is absolutely essential to steel manufacture.

FOUR of the ferro-alloy minerals (chromite, manganese, nickel and antimony) may be classed as key war materials. Others, such as tungsten and vanadium are also important. Maintenance of an adequate supply of these materials looms as one of the chief problems of war mineral production.

Chromite. Chrome steel, manufactured with this substance, is used in automobile frames, airplane and automobile motors, and in corrosion-resisting stainless steel. The United States has about 2,000 small deposits — unfortunately all low grade ore. Most of these occur in California and North Carolina. These deposits are not sufficient to suply our needs.

Russia possesses the world's greatest chromium deposits, and in the past we have leaned heavily upon imports from that country. Other pre-war chromium sources were Southern Rhodesia, the Union of South Africa, and Turkey. As can be imagined, the difficulties of ocean transportation will probably prevent us from obtaining a normal quota of chromium from these sources, which in 1934 produced more than half of our supply.

THE chief source of chromium upon which we can count at present is Cuba, whose production filled about one-fourth of our peacetime needs. New Caledonia, in the Pacific battleground, is an important source of the metal whose availability depends upon our ability to protect the Pacific shipping lanes.

In the light of these facts, it seems that we shall be forced to exploit our low grade chromium deposits to their fullest possible extent in order to suplement our uncertain imported supply.

Manganese. This is the most essential of the ferro-alloy minerals: 14 pounds of metallic manganese must go into every ton of steel to increase its strength, hardness and ease of forging. It is another mineral of which the United States has not enough.

The leading manganese deposits in this country are in Montana, Georgia, Arkansas, Virginia and Tennessee, but all of these combined have in the past produced only about $3\frac{1}{2}\%$ of our needs. We have in the past been forced to import most of our supply from Russia. Under present conditions we shall probably depend more heavily upon Brazil (whose deposits are very large) and Cuba.

Nickel. An alloy steel containing nickel is used in the manufacture of tanks, automobiles, locomotives and heavy machinery. It adds greatly to the strength of steel. Nickel also forms the layer below the chromium surface of stainless steel.

The United States produces almost no nickel; we are fortunate that our ally, Canada, mines almost 90% of the world's supply.

Antimony. An important wartime use of this metal is in the manufacture of bullets; it hardens the lead, and this quality in bullets allows them to retain their shape after bursting from the shell.

Here the United States possesses low-grade deposits which, though unprofitable commercially, can be worked to advantage in wartime. These are located in Arkansas, Nevada, Washington, California, and Utah. In peacetime, 60% of the world's antimony was produced by China; our chief wartime sources, however, will probably prove to be Mexico and Bolivia, the second and third largest producers.

Other Essential War Minerals

MANY other minerals are needed for war production, the most important being *copper* (electrical equipment; brass for cartridge cases), *lead* (ammunition; storage batteries; paint; machine bearings), *zinc* (wire; castings; making brass), and *tin* (plate, cans, solder, bronze). In mining copper, lead and zinc, the United States leads the world. Most of our tin, however, must come from abroad.

Huge copper deposits are worked in Arizona, Montana, Utah and northern Wisconsin. These are supplemented by large deposits in Peru and Chile, whose output is rapidly increasing.

Both lead and zinc are produced in great amounts in Missouri. There are other important zinc deposits in New Jersey and

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Editorial and News

Science Training and the Manpower Program

THE action of the War Manpower Board in extending draft deferment to students in science meets in part the problem of providing enough well trained scientific workers. Further action will likely be forced on our nation as the situation becomes more critical, unless a sufficient number of capable students can be encouraged to continue in science training.

It is a far cry from the time one thousand Philistines were slain with the jaw bone of an ass to the time hundreds of thousands of Germans were slaughtered with tank, plane, cannon, machine guns, and bombs. All that Samson needed against the Philistines was the sturdy bone that nature provided. But the modern soldier must have precision made tanks and guns, powder that measures up to exact standards, planes that are the best science can make, and material for all his equipment that is unequaled in quality. The inventive genius of the enemy must also be matched and excelled.

Gradually the nation is becoming conscious of the fact that the man on the farm, in the factory, and in the research laboratory is just as much in the war effort as the man on the firing line. It is now being recognized that trained scientific workers, who are far too few, can do more for their country by working in their special fields, using their knowledge and special skills in war work than by carrying a gun. As proof of this fact we again point to the recent extension of deferment to those preparing in specific scientific fields. Those who may graduate from college by 1945 in the physical sciences are in this group.

UNFORTUNATELY, general deferment of able students in undergraduate work in science came quite late, after we had suffered a severe loss of potential well trained scientific and technical workers. As a result of this drain on our potential scientific manpower, we now face the question, can our needs for scientific workers be met. Further, will provision be made for the capable oncoming students to get training in the sciences so they can fill in the ranks in industry as well as meet the needs of the armed forces? As to the first question, our needs for trained personnel are already greater than the supply. As to the second question, a definite answer cannot be had, but we believe provision will be made for training, now that we have muddled through thus far.

The experience of England shows what happens when not enough provision is made for scientific and technical training. There a technical manpower shortage developed. Shortages occurred in the following order: (1) engineers, (2) physicists, (3) doctors and dentists, (4) chemists, (5) metalurgists, (6) agriculturists, (7) mathematicians, (8) biologists, and (9) geologists. The English now have a central board that decides on the basis of available facts how many of the boys coming from the scondary schools may take special scientific or technical training and also as to what kind of training. The decision as to which students may have the training depends on scholastic ability and the results shown by aptitude tests. It is likely that a similar course will be followed in the United States. Present indications point in that direction.

(Continued on Page Forty-three)

MEETING CANCELLED

THE Indianapolis Meeting of the American Council of Science Teachers has been postponed for the duration. This is announced by the president of the American Council, Dr. Philip Johnson of Cornell University. Association members will be kept informed of the work of the association through *The Science Teacher.*

Helping in the Victory Garden Campaign

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THE Iowa Victory garden campaign has as its objectives (1) an adequate garden on every Iowa farm and (2) as large a garden as possible on every suitable city property providing the person working that garden has the training, enthusiasm and time to grow a garden.

An adequate farm garden is one at least one-fourth acre in size. This garden should supply sufficient vegetables to provide two servings of vegetables (besides potatoes) a day throughout the year. Two servings of fruit a day also are needed. These can be grown on Iowa farms if recommended cultural practices are observed. Material on vegetables and fruits is available at every county agricultural agent's office.

The science teacher can help in this victory garden campaign in three ways. First if suitable land is available a small garden may be planted where students may observe it. Recommended practices of planting dates, transplanting, cultivation, control of diseases and insects, and other cultural practices may be demonstrated. Second, help to make the needs and objectives of the victory garden program known to people in the community whenever the opportunity arises.

AND finally, the science teacher can help in the victory garden campaign by using recommended practices as teaching material to illustrate principles in science classes. For example. lettuce, radishes, beets, carrots, Irish potatoes, spinach, salsify, parsnips and onions should be planted as soon as the ground is in condition to be worked. The reason back of this recommendation is that these vegetables are ones which require low temperatures and high humidity for optimum growth. They grow very slowly when temperatures are high and rainfall is low. Generally under Iowa conditions the latter part of June is hat and dry. Hence it is imperative that these vegetables mature before that time. If plantings of these vegetables could be made at 10 day intervals in the early spring, data could be collected which would demonstrate the reason underlying early planting.

Many similar examples, from the garden could be used in the teaching of science. The following list is suggestive:

1. Potato seed pieces should be about 1½ oz. in size. Have students plant small plots using ½, 1, 1½, 2 and 3 oz. sized seed pieces and check yields
2. Apply ammonium sulphate or nitrate of Soda as a side dressing to leaf lettuce after lettuce is about 3 inches high. Note time for deep green color to appear in leaves and effect of nitrogen on leaf growth.
3. Apply nitrogen to a small portion of the row of radishes. Note development of foliage at expense of root development. Numbers 2 and 3 should enable students to see role of nitrogen in plant growth.
4. Defoliate one group of plants at regular intervals in order to demonstrate the role of leaves in the production of plant food. This demonstration should be correlated with the defoliation caused by insects and diseases under garden conditions.
5. Grow some seed saved from hybrid sweet corn in comparison with new seed of the same variety obtained from the seed house. Note the lack of uniformity in saved seed in contrast with the uniformity of hybrid seed. Explain on the basis of selfing, hybrid vigor and segregation.
6. Thin part of a row of beets, carrots and leaf lettuce to recommend distances and observe effect of thinning on quality, quantity and maturity dates.
7. Note manner in which various insecticides kill insects. Relate this information to feeding habits of the individual insects.

This demonstration material may be amplified indefinitely and should serve to make science teaching more interesting to the students.

The Importance of Insects in War Times

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(Continued from February Issue)

Most tragic of all insect-borne diseases in war time is typhus fever, t-y-p-h-u-s, a very highly fatal disease having no connection whatever with typhoid fever. Under the various names of flea-bite disease (so-called because the victims' bodies become covered with a rash of little red spots, which suggested the effects of flea bites), spotted fever, tarbardillo, ship fever, famine fever, etc. typhus fever has been well known since early in the sixteenth century, although it was not until 1909 that it was proved that it is always caused by the bites of the human body lice or "cooties." Major, in his book "Disease and Destiny" shows how profoundly typhus fever influenced the long, 16th century struggle for supremacy between Francis I, King of France and Charles V, King of Spain and Emperor of Germany. In those days, size of armies, discipline, mechanical equipment and brilliance of command were often mere puppets in the master-hand of destiny — typhus fever.

This disease gave the Prince of Orange (King William III) a totally unexpected victory over Lautrec, Marshall of France and his superior army, at the battle of Naples in 1527, and put an end to French ambitions in Italy.

In 1552, typhus fever turned the tide of battle against King Charles at Metz, where an army of 5 or 6 thousand under Francis, Duke of Guise, was besieged by Charles' army of more than 60,000. There seemed little doubt about the success of the larger invading army until typhus fever broke out among them. Then death, terror and demoralization directed a retreat during which more than half of the 60,000 soldiers died of this disease.

WITH all of Europe at war in the 16th century, this disease was spread all over the continent by the marching lice-infested soldiers. In 1544 typhus drove an imperial army under Joachim Brandenburg to retreat from an attack upon the Turks in Budapest, when more than 30,000 of his soldiers perished of typhus. After that, Budapest remained under Turkish rule for nearly 150 years.

In 1643, during the Parliamentary wars, typhus fever routed both the army of the Earl of Essex and that of Charles I, who was defending Reading, preventing either side from gaining a decisive victory. It spread to the civil population and to the jails where it persisted long after it had disappeared elsewhere. Typhus is the disease which caused court trials in the 16th century in England to be called the Black Assizes. The death of hundreds of persons following a trial of prisoners, usually beginning with the judges, sheriffs and juries, was due to typhus spread by lice crawling off of the filthy and diseased prisoners brought in to the court room for trial.

During the Napoleonic Wars, Napoleon's army of conquest marched upon Russia a half millior strong, in the spring of 1812. Less than a year later it began its retreat from Moscow with only 80,000 survivors. Two weeks later 25,000 of them had died of typhus and only 20,000 of the Grand Army ever reached the Niemen River and safety. Thus typhus fever, more than the valor of Russian soldiers, started the downfall of Napoleon.

In 1829, at the age of 32, the famous musician, Francis Schubert, died of typhus, leaving behind him over 600 beautiful songs; and thus the world was bereft of, Heaven knows how many, marvelous, unborn compositions, as beautiful as his famous "Unfinished Symphony."

FOLLOWING the great famine in Ireland in 1846, Irish immigrants brought this disease to America, starting the epidemics in the United States in 1850-51. In one year more than 45,000 Irishmen died of typhus. As others emigrated, they spread the disease to England and Scotland.

During a severe epidemic in Philadelphia

in 1823, a young physician, Wm. Wood Gerhart proved that typhus, jail fever, ship fever, and famine fever, as this infection was variously called, were all the same and distinct from typhoid, with which it has also been confused.

There was another serious outbreak in Philadelphia in 1883, and in New York City in 1891-92. In 1903 a young French physician, Charles Nicolle, was appointed Director of the Pasteur Institute in Tunis, and soon began to study typhus. He found that he could produce the disease in chimpanzees, by injecting a small quantity of blood from a person in the acute stage of the disease. He found, also, that washing his typhus patients and dressing them in clean clothing prevented the spread of the disease to others. He examined the rags worn by these patients and found that they were infested with lice and sometimes with bed bugs and fleas. He found places where typhus was prevalent but there were no bedbugs, and others where there were no bed bugs, and others where there *no lice*. He suspected that lice were the carriers. He then made experimental transmissions of typhus from monkey to monkey, *via lice*. He read his results, demonstrating that body lice are the carriers of this terrible disease, before the Academy of Science at Paris in 1909. In 1910, Ricketts of Illinois published a description of the pathogen that causes this disease, which was later named Rickettsia, in his honor; and ten days later Dr. Ricketts was dead of the disease.

TYPHUS seems to have practically disappeared from the world following the great epidemics of the late '90s, and little was heard of this plague again until the first World War, when it became the major sanitary problem. It was the worst disease that ravaged Europe during World War I. In April, 1919, in Serbia alone there was an average of about 9,000 deaths daily and that small country lost over 300,000 lives. Of 460 doctors in Serbia, 360 contracted the disease and 120 died of it. More than 10,000,000 Russians are said to have had typhus during the war period and more than 2,000,000 died. In Poland in 1920 nearly every house had typhus fever, from 1 to 5 patients, all lying upon straw- or hay-beds overrun with lice.

Unlike so many of the world's worst plagues, typhus is a disease of cold and temperate climates and prevalent from November to April, when people are staying indoors with the lice. It is associated with famine, distress due to war, poverty, squalid living, and unclean, unsanitary conditions under which the lice carriers thrive. There are normally about a thousand deaths a year in Mexico City.

IN New York City for many years there has been a disease called Brill's disease, which could not be distinguished from typhus except that it is more prevalent in warm weather and much less highly fatal. Attack confers immunity and also immunity to typhus. In nearly every case it has been found that the victims of Brill's disease are immigrants who had had typhus in Europe and recovered. Brills disease is believed to be only a recrudescence of typhus acquired in Europe, the virus having lain latent in the victim sometimes for as long as 40 years.

As in bubonic plague, there is an animal reservoir of the disease in rats, among which it is spread by the rat louse, *Polyplax spinulosis;* and Dyer has apparently proved that the tropical rat mite, *Liponyssus bacoti* and the fleas, *Xenopsylla cheopis* and *Ceratophyllus fasciatus*, may spread the infection from rats to man. However it is spread directly from man to man by the bites of the human body louse or cootie, so that the rat is not essential to its continuance.

THE fourth element in the typhus complex is the Tsutsugamushi or Japanese River Fever, a disease with fatalaties ranging from 30 to 60 per cent, caused by the pathogen, *Rickettsia orientalis*. In this case the carrier is a species of chigger mite, *Trombicula akamushi*, which lives normally upon field mice. Only the newly hatched or larval mites attack man, so that in order to transmit the disease, the larva must get the pathogens through the egg from its mother which fed upon an infected mouse as a nymph. This disease occurs in many parts of the Orient: Formosa, Sumatra, Malay, China, the Phillipines and Australia.

In addition to the ones mentioned, about 25 other typhus-like diseases have been described from various parts of the world. The possibilities of complicated interrelations of the pathogens with various insect carriers and wild animal reservoirs is enough to make one's head swim.

ANOTHER terrible disease, which we in America know little about, but which our troops will continually face on the European and Asiatic continents is bubonic plague, often called the black death. Started always by the bites of fleas, it strikes with appalling suddenness, spreads like wild fire from person to person, and has often become so epidemic that the majority of persons in entire cities have died of it. There is no remedy for this disease after the symptoms become manifest. There is a vaccine that confers some degree of protection, but is not very satisfactory.

About 430 B. C., bubonic plague devastated the City of Athens and killed one-third of the population, including their commander Pericles, designated as "the greatest man of his age." This terminated the Golden Age of Athens — bringing about her complete downfall, not only in a military way, but in philosophy, literature and art as well.

In 542 A. D., a pandemic of this disease started over the entire Roman Empire and to Constantinople. It lasted 50 to 60 years and is believed to have caused the death of 100,000,000 people.

FROM 1300 to 1400 A. D., the most terrible cycles of bubonic plague again swept over Europe and Asia, killing one-fourth of the population of all Europe; and in many large areas, as high as two-thirds to three-fourths of the inhabitants. In China 13,000,000 are said to have died and India was almost depopulated. This calamitous visitation of "the black death" exercised a profound influence upon the life of the world: it marked the end of the Middle Ages. A lowered standard of morals followed. The church lost its influence. Property changed hands so rapidly, laborers became so scarce that there was an opportunity to jump wages and reduce working hours, and a new era in the economic history of Europe began. A new thirst for greater knowledge gave rise to the Renaissance and led to the Reformation.

In 1664 to 1668 the Great Plague of the City of London killed one in eight of their entire population. The plague practically disappeared from England about 1680, after having been more or less continually a menace for 140 years during which time there were five or six great epidemics.

THE most recent pandemic of black death started from a reservoir in the bodies of rodents known as tarbagans, in Manchuria in 1890-1895. Chinese, hunting these animals for their fur, were bitten by the fleas that infested the tarbagans and as they returned home spread the epidemic all over China. From China it spread to India where 4,097,764 deaths were recorded from 1896 to 1905. From the Orient the disease was carried to American seaport towns in the bodies of flea-infested rats on shipboard. As the rats die of the disease the fleas start hopping about in search of blood and infect human beings as they bite them. In this way, an alarming outbreak started in San Francisco in 1900. Another flare-up began in 1907, again in 1912, and in 1922. New Orleans has a scare in 1914, Galveston in 1920 and Los Angeles in 1924-25. Although all of these American outbreaks have been subdued, it is a grave fact that the pathogen of this disease, a bacillus named *Pasteurella pestis*, has become established among the ground squirrels of the western states, among which it is spread by the bites of the squirrel flea. Fortunately this flea refuses to take human blood; but from the squirrel reservoir this sylvatic plague may continually spread to rats and then by the rat fleas to man. The disease is now endemic in nearly all of our western states, as far east as Wyoming, Montana, Arizona, New Mexico and North and South Dakota. Recently it has been found that a flea, known as the stick-tight flea (which attacks nearly all kinds of birds, as well as cats, dogs, horses and man) can disseminate the plague pathogens, as can at least 15 other species of fleas. Migratory birds such as hawks and owls are

often infested by these stick-tight fleas and might quickly spread the disease hundreds of miles. The fact that these birds prey upon the ground squirrels and so carry the germs to their nests and infect all the nestling birds, adds another complication to the present threat of plague in America. The American Medical Association has issued a warning that war conditions may cause a frightful epidemic of plague to sweep over the United States as it has many times done in Europe and Asia.

Recently a case of typhus was discovered in a trailer occupied by war industry laborers in Detroit. Another fact that adds gravity to the local situation here in the middle west is that the Indian Rat Flea, the worst and principal disseminator of the disease in the oriental epidemics, has become established in the North Central states. It has been taken here in Urbana and at several other points in Illinois; at Ames, Iowa, and at Minneapolis. If migrating birds, migrating persons or migrating rodents should bridge the gap between the reservoir of plague bacilli in the western ground squirrels and our local rat fleas, we might easily experience an epidemic of plague that would cause previous outbreaks of influenza, smallpox, typhoid and infantile paralysis to pale to insignificance. I would like to warn all householders and city officials of the unusual importance of fighting rats and fleas now as never before.

APPARENTLY malaria is at present very active on numerous war fronts. It is an outstanding health problem on the island of Trinidad, recently acquired U. S. military base. Along the Burma Road in China American troops, truck drivers and Tiger airplane fliers have been heavily infested with malaria a short time after their arrival in that area. And in Malay malaria has been very prevalent especially among the Japanese troops. Malaria is a terribly devastating disease, exclusively insect-borne; but it is not very highly fatal.

Another mosquito-borne disease which is almost 100 per cent fatal is yellow fever. It ranks in seriousness with typhus and bubonic plague. Until the beginning of the present century it was considered the most terrible human disease in tropical countries. United States cities have had serious epidemics also. Boston suffered from 1691 to 1693. New York City in 1668 and again in 1856. Baltimore experienced an epidemic in 1819. The Memphis outbreak caused 8,000 deaths. The great plague of yellow fever in Philadelphia in 1793 took the lives of one person out of every ten. New Orleans has been the greatest sufferer in the continental United States. A series of epidemics there during the past century resulted in a total of over 40,000 deaths. Havana, Cuba averaged 500 to 1000 deaths a year for more than a century. Yellow fever completely wiped out the Mayas, whose civilization thrived in Yucatan and Guatemala for centuries but ceased about 1576. This disease also practically wiped out the white population on the Island of Haiti and transferred the ownership of that country to the African negroes, who were imported by the Spaniards as slaves and who had considerable immunity to yellow fever, because of long association with it in their native land.

THIS disease also turned the tide of world history in a way that has especial significance for the United States in the present crisis. It was the only thing that prevented the French from building the Panama Canal, long before Uncle Sam thought of doing so. Yellow fever killed such a large proportion of the workmen, engineers, doctors and nurses who were brought from France to Panama that De Lesseps failed miserably and the project had to be abandoned — not from lack of technical engineering skill or experience, nor for want of financial backing, but solely due to a single species of mosquito, the tiger mosquito, whose bites alone spread the disease in that area. It is impressive to speculate as to the effect upon the present world situation if the French had succeeded at Panama and maintained the strategic control of Central America until they were defeated by Germany. It is a position as profound and far-reaching as the British control of the Suez canal.

All the world knows how the research of Walter Reed and his American Yellow Fever

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The Determination of the Vitamins

II. Chemical Methods

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ANYONE considering the development of chemical methods of vitamin analysis must be impressed by the tremendous improvements that have been made during the last five years. The only vitamin that had an acceptable chemical method of analysis that far back was vitamin C. The standards for good nutrition are much higher for vitamin C, being about 75 milligrams, than for any other vitamin. With the exception of nicotinic acid all others would require a method about fifty times as sensitive.

Why has this development taken place? Probably there are several reasons for this. Pure synthetic crystalline vitamins are readily available. One might say that the outbursts of pointed but unscientific language by people trying to get results with older methods had some effect. Few things could be more irritating than to have an important investigation held up six weeks while waiting for an animay assay. However, this disturbance had existed for some years before and, while it may have increased in volume, it was hardly enough to account for all of the progress.

ONE of the factors that has had an important effect has been the development of satisfactory photoelectric colorimeters. These instruments now furnish us with accurate quantitative measurements of light. Using proper filters it is possible to measure light absorption by colored solutions or light emission by fluorescence of thiamin and riboflavin. Spectrophotimeters are available which can be adjusted immediately to allow a narrow band of light to pass through and cut out the rest. This makes it possible to choose the point of maximum absorption by the color to be measured.

Vitamins are usually divided into water-soluble and "fat" soluble classes. The term "fat" soluble means that these vitamins are soluble in fats and that they are soluble in the same solvents that dissolve fats. This division obviously will determine the methods of extraction. Water-soluble vitamins will be extracted with water or dilute acid solutions, "fat" soluble vitamins with organic solvents such as petroleum ether.

Suppose we start with vitamin A, a "fat" soluble vitamin. The picture here is complicated by the fact that there is more than one chemical compound that the animal body can use as a source of the vitamin. These compounds are known as precursers. Some furnish more vitamin A than others and different species differ in their ability to convert the various precursers to vitamin A.

Vitamin A as such is found only in animal materials. Butter, eggs, whole milk, liver and particularly fish liver oils are sources. A sample of the material to be analyzed is saponified with potassium hydroxide to remove the fat. It is carried through a number of purification procedures until the vitamin is present in some solvent such as chloroform or cyclohexane. These procedures should be carried out under carefully controlled conditions because the vitamin is easily oxidized by air. After the final purification is accomplished there are two acceptable methods of quantitative evaluating the vitamin. One is to read the absorption of light as a wave band around 328 mu using a spectrograph or a spectrophotometer. This is considerably below the absorption band of most materials and works quite well on any material where vitamin concentration is high.

THE second method is known as the Carr-Price reaction. When antimony trichloride is added to a solution of the vitamin in dry chloroform a fleeting blue color is formed. By carefully regulating conditions and the time of reading, it is possible to measure this color and get a quantitative measurement of the vitamin A content of the solution. This

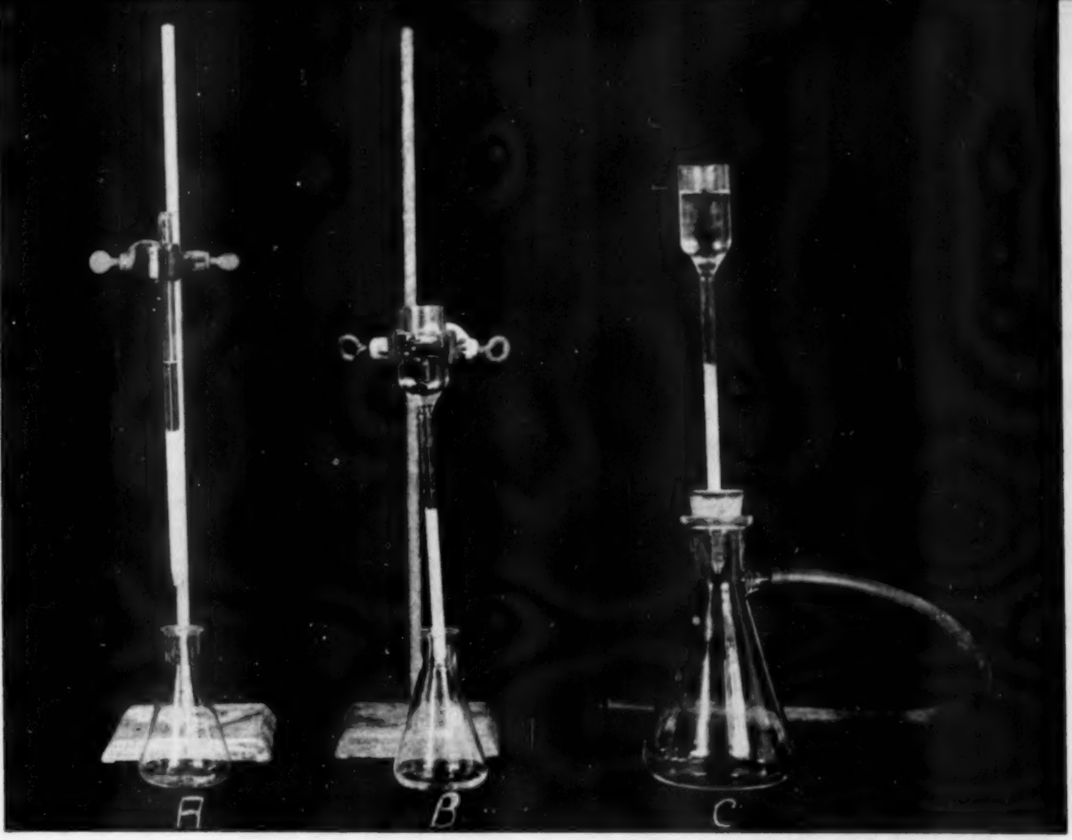


Fig. 1. Tube A is packed with magnesium carbonate for separation of carotene; apparatus B and C provides a two stage separation of thiamin and riboflavin.

procedure from the time of addition of the reagent until the reading is taken must not take over 15 to 30 seconds. The blue color starts to fade after that. Both methods have to be corrected for carotene.

It is possible to secure many vitamins in the pure crystalline form at the present time. This is true of vitamin A but it is difficult to handle without destruction. The common standard is U.S.P. reference cod liver oil. This is a cod liver oil which has been very carefully standardized and preserved by the U. S. Pharmacopeia board.

Beta carotene occurs in both animal and plant materials. Vitamin A is found only in animal products and can be forgotten in the analysis of vegetables. Other complications arise, however, because beta carotene is not the only precurses of vitamin A present in plant material. There is a large group of compounds known as carotenoids. These include alpha, beta and gamma carotene, cryptoxanthin and neo-cryptoxanthin, all having vitamin A activity, and many other compounds with no vitamin A potency. About 65 percent of the active carotenoids in yellow corn are cryptaxanthins. Carrots contain about 10 percent as much alpha carotene as beta carotene. These compounds are all closely related. Beta carotene is really two vitamin A molecules hooked together. If the animal body can break them apart efficiently, there are two molecules of vitamin A ready for use. The other compounds have one vitamin A molecule and have only half the potency of beta carotene.

Plants differ greatly in the amount and type of these compounds. In general they are associated with the green and yellow color but this is a rough guide. For example, the green color in plants is due to chlorophyll, and, while this often accompanied by beta carotene, it is not necessarily so and the ratios vary greatly. The green color of hay disappears at a different rate than the destruction of beta carotene. The farmer is in a peculiar position when curing hay. Sunlight irradiates the hay and increases the vitamin D potency while gradually destroying the vitamin A potency.

(Continued on Page Thirty-Six)

Apparatus to Demonstrate the Jackscrew

M. J. W. PHILLIPS

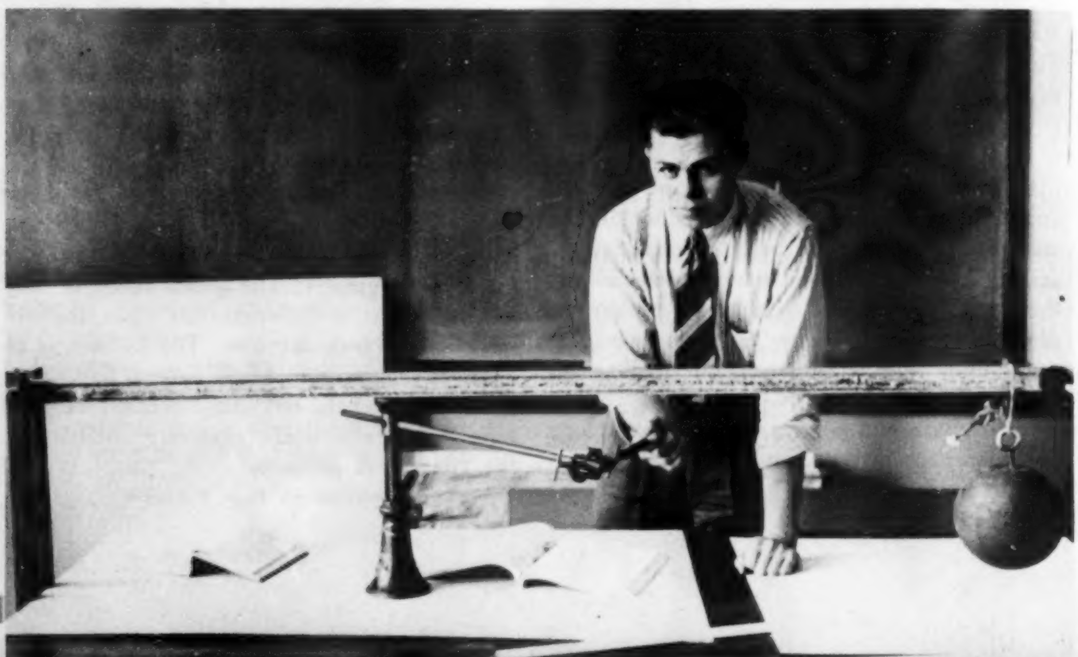
West Allis High School — West Allis, Wisconsin

THE demonstration of the commercial form of jackscrew to high school physics classes has limitations. It appeared to the writer almost impossible to use the commercial jackscrew on a demonstration table without pulling out the plates holding the upright rods and doing other damage to the table.

To overcome this difficulty and at the same time allow a wide range of forces to which the screw may be applied, this equipment was built. The essential part is two eighteen inch lengths of $1\frac{1}{2}$ x $1\frac{1}{2}$ inch angle iron and one piece of angle iron the same dimensions, the length of which is the width of the laboratory table top, in this case 34 inches. These pieces of angle iron may be obtained in junk yards or the side rail of a discarded iron bed may be used. The pieces of angle iron are drilled for $\frac{1}{4}$ inch machine bolts. There are 4 of these bolts, 1 inch long. Actual dimensions cannot be given as they depend upon the table upon which it is to be used as well as the type of iron available. The detailed photographs, Figure II, shows how these three angle irons are fastened together with the four $\frac{1}{4}$ inch machine bolts.

THE assembled piece of angle iron is then fastened to the end of the table as shown in photograph, Figure I, and the end view photograph, Figure II. Near the top of the two eighteen inch upright pieces of angle iron, a $\frac{1}{2}$ inch hole is drilled for a $\frac{1}{2}$ x 4 inch machine bolt. This serves as the fulcrum. The lever arm is a six foot piece of channel iron or I beam; in the illustration a piece of miniature railroad rail is used. One end is drilled to accommodate the $\frac{1}{2}$ inch machine bolt to hold it in place at the fulcrum. The detail of this is clearly shown in the photographs and the drawing, Figure III. The jackscrew is a commercial type, 5 ton capacity, the smallest made, costing less than a dollar from a mail order house. The jackscrew is placed under the beam or lever. A weight of considerable size is placed at the end of the beam. This is an iron ball weighing about 60 pounds. If iron cannot be obtained to make the lever arrangement, wood such as a 6 foot piece of 2x4 or 2x6 may be used. The weight on the end of the lever to provide the force, may be an old discarded pail filled with rock and cement and allowed to harden.

Fig. I. Using an angle iron and weight to demonstrate advantage of a jackscrew.



THE jackscrew can be placed in any position between the fulcrum and the weight. The weight of the lever can be taken into account. With this lever arrangement forces up to 1500 lbs can be applied to the jackscrew without damage to the table and fixtures. A wide variety of forces can be calculated for the jackscrew. All the principles involving the lever may be taught with this equipment. It is inexpensive and easily made by the pupils in a physics class.

Physics students have difficulty in vizualizing the screw as a form of inclined plane. A project presented to the class sometime before the demonstration is given, will serve as an aid to making clear the concept of "pitch," and its relation to the diameter. The drawing, Figure IV, shows how this is done. Using a piece of wrapping paper, lay out a right angled triangle, base 36 inches long and height 6 inches. Color the line along the hypotenuse with a colored pencil, this being

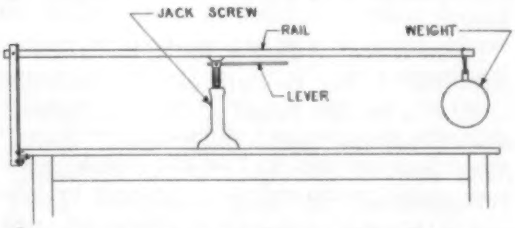


Fig. 3. Detail of apparatus for demonstrating jack screw.

the incline of the inclined plane. This colored line becomes the thread of the screw, when this triangle is cut out and wrapped around a piece of broom handle or other cylindrical object. Using cylinders of different diameters and wrapping the same paper triangle around each, show the difference in the distance between successive threads of the resulting screw. It is well to allow the pupils to select their dimensions and then bring the completed projects to the class for comparison and discussion.

This demonstration serves to sum up for the physics class such fundamental items in mechanics as center of gravity, law of the lever, work done upon the screw, work accomplished by the screw, force of friction (which is great in the case of the screw),

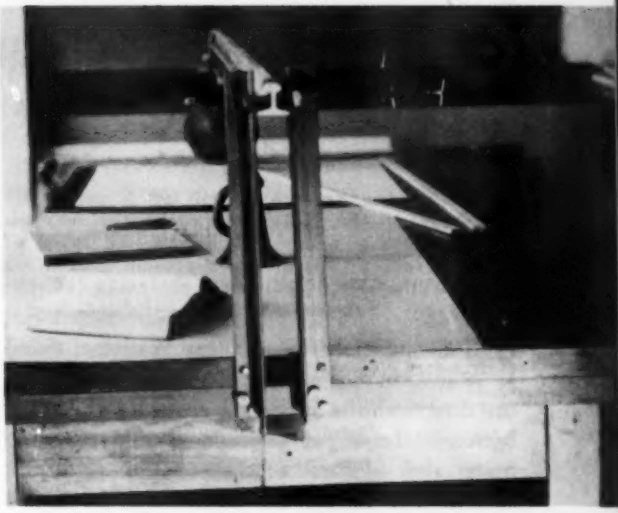
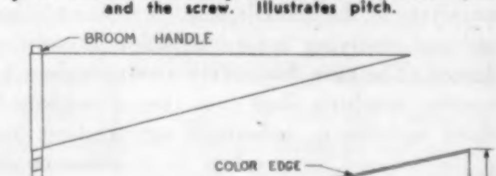


Fig. 2. End view of apparatus showing attachment of angle iron to table.

mechanical advantage, in fact, all of simple mechanics. The following is a list of the materials needed for this quipment:

- 2—1½x1½ inch angle iron 18 inches long.
- 1—1½x1½ inch angle iron 34 inches long.
- 1—6 foot piece of channel iron.
- 1—½x4 inch machine bolt.
- 4—¼x1 inch machine bolts.
- 1—½x24 inch iron bar used as a handle to turn the jackscrew.
- 1—¼ inch "eye" bolt for end of above bar to hook spring balance to measure force exerted upon the screw.
- 1—Spring balance, 0 to 25 lbs. Ordinary type found in any hardware store.
- 1—Jackscrew, commercial form, 6 inch screw, 5 ton capacity. Found in mail order catalog, costs less than one dollar.
- 1—Weight, about 50 pounds.

Fig. 4. Method of showing relation between incline plane and the screw. Illustrates pitch.



Applying Science Teaching for Better Living

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Radio Station WBOE Cleveland, Ohio

This is the second article of a series by members of the National Committee on Science Teaching sponsored by the Division of Science Instruction of the National Education Association. Mr. Neal was chairman of the Philosophy Sub-committee. —Editor.

FOR the past three years the National Committee on Science Teaching has worked in the direction of effecting a closer relationship between classroom procedures and teaching materials and some of the common problems of everyday living. The over-all program developed by the National Committe on Science Teaching had been summarized in a previous article in this series. It is the purpose of this discusion to indicate one practical illustration of use of the report of the Philosophy Sub-committee.*

There is nothing new or unique about the idea of functional teaching, of relating science teaching to the problems of everyday living. Indeed the utilitarian aim has been emphasized since the early days and functional outcomes have to some extent been achieved. However, it is generally agreed that science teachers could in many cases effect a much closer relation of classroom materials to actual life situations.

THE war has served to functionize science teaching along certain lines with a speed which would not have been believed possible when the National Committee undertook it's initial deliberations. Many thousands of pupils are learning the fundamentals of aviation, navigation and technical communication practices in record time. Health materials in the schools have been intensified and are receiving major attention in science classes. The case for safety consciousness in science teaching has not been neglected. Many courses in industrial safety, first aid to the injured, and safety in relation to civilian defense are finding their way into classrooms where safety education was formerly little known. New emphasis is being placed on the scientific methods as an aid to production of war materials and necessities for the home front. Perhaps it is safe to say that considerably less emphasis is being given to the areas of occupational perspective, recreational opportunity, conservation mindedness, and intelligent consumption than would have been the case if the urgency of the war program had not of necessity become uppermost in the minds of science teachers. Perhaps it is also safe to say that scientific methods of solving the common problems of everyday living are receiving less attention than was the case preceding the war.

In the school system in which the writer is employed it has recently become desirable to write a revised course of study in general science for the junior high school grades. After study of the report of the Philosophy Sub-committee the local committee undertook to build a course of study which would recognize the urgent needs of the times as well as be permeated with the broader program recommended in the report.

Pertinent Materials From the Report of the Philosophy Sub-committee

Science Teaching Should Contribute to Better Health. The time-honored health objective remains a cardinal principle in modern educational thought. Continued emphasis on this topic in science teaching may well include: careful consideration of, and recommendations for practice in, healthful exercise; attention to established and new information and practices in the field of nutrition; concern over the harmful effects of worry, fatigue, drugs, and various kinds of excesses; application of the scientific method to controversial issues related to health; and development of desirable personal and community health habits.

*** "Science Teaching for Better Living" American Council of Science Teachers of the National Education Asociation, 1201 Sixteenth St., Washington, D. C.**

TO develop the attitudes necessary to accomplish these results, teachers of science must depart from the tradition of covering a given number of facts in physiology and hygiene. There needs to be a direct approach to problems.

Health habits, of course, should be based on a suitable minimum understanding of factual information, but health knowledge is worthless unless put to intelligent use. The most important criterion for the selection of teaching material is the degree to which it influences pupils in their choices, actions, and attitudes. The selection should be made only after teacher and pupils have cooperatively viewed the most significant personal and community problems and have reached a common agreement on how to proceed.

The Case for Safety Consciousness in Science Teaching. The hazards of modern living indicate that definite steps should be taken to arouse safety consciousness on the part of the public. Hence the science program should include such topics as the prevention of accidents at home, in school, in recreational activities, in industry, and on the highway. It should also provide a complete understanding of the details of first aid, since a knowledge of first aid is an important accompaniment to safety.

The science program of the secondary school offers an excellent opportunity for the development of safety consciousness. This program might well include, or be included in such topics as fires and fire prevention; combustion and explosive mixtures; alcohol, narcotics, and poisons and their effects upon the body; the mechanics of safe driving, involving the principles of inertia, motion, friction, centrifugal force, and operation of gasoline engines; the use of chemicals commonly found in the home.

Science Teaching May Aid in Orientation to Work. Though it is not the primary function of science education to provide training for specific jobs, yet much can be done to develop occupational perspective. Pupils may be orientated, for instance, especially in the more advanced courses, by considering occupations and trends in work related to their interests. In this connection they may consider such factors as the preparation required, the remuneration provided, the hazards involved, and the satisfactions that come from the work. Also they may consider which occupations offer the greatest opportunities for success and advancement.

The strictly vocational aspects of science teaching are not to be ignored. Many physicians, physicists, chemists, zoologists, bacteriologists, and workers in other important fields of scientific specializations have received part of their basic training in science courses below the college level. It is not uncommon for high school graduates to be guided into jobs for which they have better than average qualifications because of science courses taken.

Science Teaching May Contribute Much to Recreational Opportunities. The present trends in social and economic living indicate a great and growing need for the promotion of recreational interests and the intelligent use of leisure time.

SCIENCE teachers can help to develop recreational interests by emphasizing the importance of participating in games; the advantages of spending time in the outdoor area of streams, lakes, and forests; the benefits of hiking over readily available trails or of using established playgrounds; and the pleasurable outcomes of studying the fauna, flora, and geological aspects of the environment. Much can also be done to encourage desirable recreational habits through the organization of clubs such as camping clubs and 4-H clubs. The field of science offers great opportunities for recreational growth through hobbies and avocational interests.

These and other avocational interests related to science have great possibility for recreational opportunity for increasingly large groups. The science teacher must be aware of his obligations in this field.

Science Teaching May Develop Conservation-Mindedness. Conservation is one of the chief concerns of modern c ivilization. Thoughtful leaders everywhere realize that unless people develop greater interest in conservation, present standards of living are certain to decline.

Science education offers an unusual opportunity for the development of conservation-mindedness. The study of minerals in chemistry and other sciences affords an opportunity to show that the real meaning of conservation is not the mere saving of materials and energy, but rather the intelligent use of resources and the development of plans for their replacement. Likewise they see that the laws of conservation of energy and materials which are disclosed by science are basic to the program of conservation being attempted by society.

Science Teaching May Promote Intelligent Consumership. The problem of intelligent consumption occurs in some manner in almost every activity of life.

The average citizen is confronted many times daily with propaganda, some of which may be harmless but some of which may be very detrimental. Science teachers can render important service in this area by helping pupils to assemble and interpret evidence, thus providing an intelligent basis for attitudes, choices, and actions.

Each area of the curriculum has consumer aspects, but science is especially helpful because its facts and principles supply direct answers to many consumer problems.

Further Approaches to Functional Science Teaching. The foregoing statement emphasizing the functional aspects of science teaching is not intended to negate other important outcomes of science education. In other words, it in no wise intimates that science teachers should forget or discard information, attitudes, skills, generalizations, and appreciations which have proved helpful and effective in the past. Nor is it likely that the examples of functional areas discussed here will prove equally acceptable in all teaching situations. These examples merely represent some of the efforts of science teachers to reshape their thinking and teaching and thus to help the pupils under their direction solve everyday problems of personal and social significance. Again it may be said that the statements are in no sense prescriptive.

Local Committee Point of View

AFTER study and discussion of the above materials along with other parts of the report of the Philosophy Sub-committee, the local committee undertook to select areas of functional outcomes which seemed timely and appropriate for emphasis in science teaching in the local situation. These areas, after much discussion, were listed as follows:

Scientific Methods and Fundamental Concepts

Health, recreation, safety, communications, transportation and the development of air mindedness, consumer science, conservation, and occupational perspective.

The local committee does not hold the point of view that all of the areas listed are of the same order or importance. It is contended, however, that each represents a phase of modern living in which it is important to modify the thinking and behavior of large groups of people. The course of study in general science was rewritten with functional outcomes in these areas constantly in mind. The titles of the teaching units of the course of study are listed in the table below. The course is intended for one five day per week semester each in the seventh and eighth grades, and two five day per week semesters in the ninth grade.

Units for Instruction in Science — Junior High Schools

	7B or 7A	
I.	Measurement of Growth and Physical Condition	5 weeks
II.	Tuberculosis Control	1 week
III.	Gardening—Why, Where, How	3 weeks
IV.	Functions and Hygiene of the Great Organ Systems—Including Safety and First Aid	9 weeks
	8B or 8A	
I.	Science at Work	1 week
II.	Meteorology Today—the World's Air and Weather	3 weeks
III.	Astronomy—the World in Space	3 "
IV.	Factors Affecting Growth and Health	5 "
V.	Gardening for Home Improvement—Including a Study of Rocks and Soils	4 "
VI.	Conservation of Wild Life	2 "

9B

I. Elements and Compounds—Including Conservvation of Basic Materials	4	"
II. Water—Uses in Modern Living	3	"
III. Forces—the World's Sources of Energy	4	"
IV. Machines—Harnessing Energy for Living Today	4	"
V. Human Behavior—Learning to Work Together	3	"

9A

I. Sound—Increasing Uses in Communication	3	"
II. Heat and Fuels--Home, Industrial and Transportation Applications	3	"
III. Electricity—Basic Aspects in a Changing World ..	6	"
IV. Light—Nature and Effects of	4	"
V. Gardening—Plants in the Service of Man	2	"

EACH of the teaching units has been enlarged into an outline of teaching topics. In addition the areas of functional outcomes were included as a part of each unit, and the appropriate topics from the teaching outline of each unit were then relisted under the proper functional headings. The committee has thus attempted to relate the subject matter of general science to definite practical aspects and problems of everyday living. The following example of the procedure used is one teaching unit of the course of study.

Light—Nature and Effects of Suggested Topics

I. Overview of light: (a) relation of light to functional areas

II. Theory of Light: (a) waves, (b) speed, (c) sources, (d) behavior.

III. Home and industrial lighting: (a) direct and indirect, (b) lighting fixtures, —incandescent and fluorescent, (c) home lighting, (d) industrial lighting.

IV. Street and park lighting.

V. Photography: (a) lenses, (b) cameras, (c) light meters, (d) films, (e) aerial.

VI. Optical instruments: (a) mirrors, (b) microscopes, (c) telescopes, (d) bimicroscopes, (c) telescopes, (d) binoculars.

VII. Color.

VIII. Conservation of light energy: (a) light energy from coal, (b) light energy from water power.

IX. Working in the field of light: (a) astronomer, (b) lens maker, (c) commercial photographer

X. The human eye: (a) structure, (b) care.

THE results of the local committee's efforts are obviously far from perfection. However, it is the considered opinion of the members of the committee that the present status of the course of study is a beginning step in the direction of functionizing junior high school science materials. The committee is continuing to study the problems involved. An added project which will be undertaken includes the investigation and listing of suitable supplementary reading material, and a study of recommended visual aids.

A somewhat unique aspect of the total curriculum in junior high school science is the use made of the Cleveland Public Schools Radio Station WBOE, which operates at 42,500kilocycles, Frequency Modulation. At approximately weekly intervals local authorities who donate the time, and occasionally visiting scientists, broadcast fifteen minute programs related to the course of study. These programs are availible to the science classes through the schools FM receivers and public address systems. The local Academy of Medicine has been especially helpful in cooperating on these broadcasts. The programs are recorded and repeated a number of times on given days of each week. Many of the broadcasts are of such a nature that they are valuable for use for more than one semester. In nearly all cases the programs broadcast to science classes bring information or a point of view which could not otherwise be made directly available to the pupils.

Science Clubs at Work

Edited by DR. ANNA A. SCHNIEB

STATE TEACHERS COLLEGE RICHMOND, KENTUCKY

WE are indebted to Dr. Howard E. Enders, Counselor Indiana Junior Academy of Science, for securing the articles in this department. The Indiana Junior Academy is to be commended for the very practical and timely work it is carrying on and for the well-written articles submitted. These contain excellent references and suggestions which will be helpful to club sponsors and to club members. —Anna A. Schnieb

Junior Academy of Science Looks Ahead

MERILYN EVARTS and EILEEN BROCK
High School Students
Elkhart High School Elkhart, Indiana

IN 1941-42, the Elkhart Chapter of the Junior Academy of Science cooperated with the Indiana Historical Society in its effort to make the parks, highways, and landscapes of our state more beautiful. This we did by selling our state tree, the tulip tree, to the citizens of Elkhart. Our goal was to make Elkhart the "tulip tree town of America." There are approximately one thousand city blocks in our city and we sold a total of two thousand three hundred trees.

Since the science of flight seems to have taken America by storm, in 1943 our Junior Academy of Science again looked ahead by taking up the study of aero-biology. Each club member took a certain section in which he was interested making investigations and working it up in the form of a report with drawings. These drawings will be photographed and made into lantern slides. We plan to take the completed project to the 1943 state meeting and also as an exchange program with a nearby Junior Academy Club.

AS we have been studying aero-biology, we have discovered many interesting things. To mention all of these would fill a book, but we have tried to give just a few of the most outstanding ones in this article.

Physical fitness is the most important faccor in choosing a pilot. Contrary to popular belief, not all people who have the ability to resist airsickness, altitude sickness, effects of low temperature, results of acceleration, and aeroembolism make good pilots, nor do obviously strong and vigorous athletes. The first need of an aviator is a sound nervous system and for this reason the medical histories and personal habits of the individual fainting spells, amnesia, or the habitual user are studied. If he is a victim of epilepsy, of narcotics, he is disqualified.

His sharpness of vision or acuity must be reasonably good. This is tested by having

The club president learns the shortest route to Tokyo.

Students instruct others in photography.

the subject sit twenty feet away from a chart and read letters of diminishing size. Most candidates for military classification must be one hundred per cent or 20/20 which is the ability to read a certain line accurately with both eyes. Depth perception and coordination of the eyes are also important. Because making emergency landings as well as reading lights depend upon his ability to distinguish colors, color blindness disqualifies a candidate for service as an army or navy pilot or for airline and commercial work,

Pilots must have acute hearing for the safety of the plane in flight may depend upon whether or not messages and signals are recived. Trainees of the army, navy, and civilian pilot training program are required to hear whispered numbers at a distance of twenty feet with either ear.

Good powers of balance have proved to be so important that all classes of pilots are disqualified if they fail to meet the accepted standard. Closely related to balance is coordination, the harmonious working together of various parts of the body. Any marked abnormality of the muscles may disqualify a candidate for army of navy air services.

IN flight activities, the circulatory system is of first rank importance. Army examinations require a systolic pressure of no more than 150 mm. However those who apply for actual flight training must have a systolic pressure less than 135 mm. and a diastolic pressure less than 90 mm.

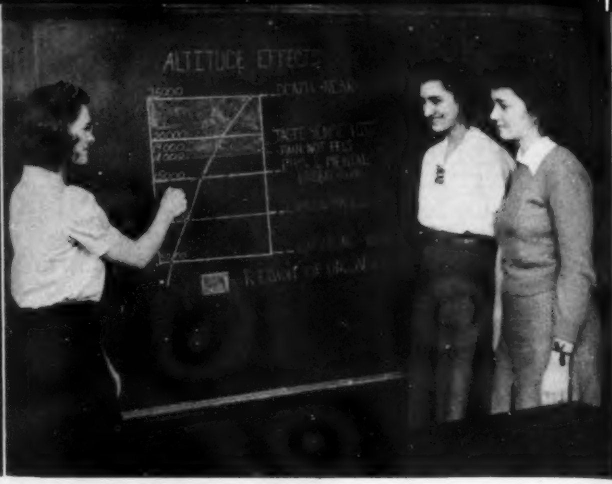
Other ailments, depending upon their nature, may or may not disqualify a candidate for admisison to military flight service. Those which are likely to be of a permanent nature such as stomach ulcers, heart ailments, chronic kidney disease, or poor functioning of the ductless glands, as well as temporary defects, such as tooth decay, will at least temporarily disqualify men for military filght purposes.

Why are these strict physical requirements necessary?

Man is adapted to live on earth and so it is not any wonder that his sense organs are inadequate in learning to fly. On the ground we maintain our balance by impressions from our eyes; therefore the eye is the primary sense organ of the flier.

TO HAVE good eyesight and to maintain it, a pilot's diet must be high in vitamin A content. The eyes differ from the other organs of balance in that they are not affected by linear accelerations, the pull of gravity, or centrifugal force.

The semicircular canals in the ears, our chief balancing organ on earth, often give false impressions while in flight. For ex-

Above left: explaining effect of flight on circulation of blood; right: studying effect of altitude.

ample, when a pilot goes into a spin, the fluid in the semicircular canals develops the same motion as that of the canal so that the sensory hairs become upright in position. For this reason, if the pilot shuts his eyes, he has the false impression that he has stopped turning. Also when the pilot turns out of a spin, he has the sensation of turning in the direction opposite to that of the spin.

Another balancing organ consists of the saccule and utricle, two small sacs located in the inner ear. These contain membranes of sensory hairs on which rest many crystals of calcium carbonate or lime. The inertia of these crystals causes the hairs to bend and is interpreted in the brain as movements in specific directions.

WHEN a pilot banks his plane in a turn vertically, centrifugal force acts in the direction of the horizon and again the pilot is given a false impression. Many false impressions are given while the pilot is flying blind so that he must learn that: "The sense organs may deceive, but the instruments tell the truth."

Acceleration produces the most sudden and dramatic results in flight. It may be a gain in speed, a decrease in speed, or a constant speed in a curved path.

Transverse accelerations are those whose acceleration forces that act from front to back, back to front and side to side of a body. They may be illustrated in take-offs and landings and are, for the most part, harmless. Positive accelerations act in the direction of head to foot Examples are sharp inside loops and pull-outs from power dives.

WHEN a plane is pulled out of a dive, the amount of centrifugal force depends upon its velocity, mass, and the radius of the curve. Centrifugal force equals about 4.3 gravities when the speed is only 187.5 miles per hour and the radius of the curve is five hundred feet. Most pilots can withstand this amount of acceleration without serious effects.

If five gravities are experienced, there is a clouding of vision, just as if there were a fog before the eyes. At five to six gravities the average pilot suffers a complete but temporary loss of sight which is called a blackout, This blackout is due to the fact that the force acting from head to feet prevents blood from being pumped normally from the heart to the head. As a rule, blackouts last from one to twenty seconds and usually consciousness is not lost; however, at six to eight gravities the pilot does lose consciousness.

SHORT, heavy people are not as susceptible to blackouts as are tall persons, because the distance that the heart must force the blood to the brain is less. Even though blacking out lasts only a few seconds and its victims never experience anything more serious than mental confusion, it could prove disastrous in combat because only a few seconds are required to shoot down a plane.

The most practical way to prevent a blackout is to sit crouched forward. This tilts the large blood vessels at an angle with the accelerating force producing a pressure on the abdomen which prevents the pooling of blood in that area. Other measures to prevent an abnormal amount of blood in the head

(Continued from Page Forty-one)

Our Nature Study Club Activities

CHARLOTTE L. GRANT
Arsenal Technical High School — Indianapolis, Indiana

THE two main objectives of the club are learning and practicing conservation physical fitness.

To achieve the first, students will present panel discussions throughout the year on "Science and the War Effort." In these will be considered "Food and Food Substitutes;" "Natural and Synthetic Fibers"; "Coal, Oil and Rationing"; "Natural and Synthetic Rubber"; "Drugs and Drug Substitutes"; "Soils and Gardening"; "Wood in the War"; and "Animals in War Production."

As part of the program in conservation a war project sponsored by Science Clubs of America, is being undertaken for the second semester. A period of general and specialized training will be given by the U. S. Forest Service, through pamphlet materials and suggestions for using this material. This training will enable club members to become "deputies" of the U. S. Forest Service in their own communities, thus bringing added protection to our forests and educating the citizenry of tomorrow through the youth of today.

SEVERAL motion pictures already ordered will contribute to the consideration of conservation. There are: "Conservation of Our Natural Resources," "Tree of Life," "Science and Agriculture," "Farm and City Forward Together," and "Plastics — the Fourth Kingdom."

A panel on "Attention to your Health" was presented in Early October. "Hobbies" and "Outdoor Exercise" have also been discussed as part of the physical fitness program. Perhaps the club's most important endeavors in this direction are the Saturday hikes taken by members.

OUTSIDE speakers, such as Mr. Albert Harwell from the National Audubon Society with his bird imitations and natural color movies of birds, bring enjoyment and variety to the club program.

Student projects such as chemical gardening, wood study, nature photography and insect studies stimulate interest and out-of-door activity. Several papers and exhibits on these subjects have been presented at Indiana Junior Academy meetings.

How Much Food For Your Ration Points?

Every teacher will remember the ration registration days during the last week in February. I guess everybody will, for that matter. My wife spread out before me a newspaper copy of the "Official Table of Point Values for Processed Foods, No. 1, Effective March 1, 1943."

The initial reaction of bewilderment soon subsided as we pored over this chart of numbers. We would be required to pay two prices for each rationed item. One was the customary money price, the other a price in points. That was clear. We concluded that, for us, points were more scarce than money. As a matter of fact, I could try to earn more money by finding part time employment in addition to my regular occupation, or we could economize a little more on movies or on clothing, so that we could pay for the food we wanted. But, there was no way of acquiring more points than anybody else received.

For eight points we could buy a pound of dates, while a pound of prunes cost twenty points. But, there was sauerkraut at four points. For one's monthly allowance of forty-eight points, one could buy twelve pounds of canned sauerkraut or less than two and one half pounds of prunes. No sooner did we think we had the situation in hand than new clouds of complication appeared on the horizon. While forty-eight ration points will buy about five times as many pounds of sauerkraut as of prunes, it does not follow that we shall receive more nourishment by spending our points on the former. I recalled the reports that came thru, not so many years ago, of the poor inhabitants of certain sections of the country who filled their stomachs with flavoured clay at a cent or so a pound and wound up with pellagra and what not. I knew, of course, that sauerkraut has valuable nutritional qualities. But, the point was, that bulk was not the important criterion.

My desk was soon littered with reference books and charts. The following hours found me, with slide rule in hand, completely submerged in this alluring problem. The accompanying chart is the result. (Figures are in round numbers.) Calorie values have no bearing in this evaluation because these can readily be supplied by as yet unrationed foods. The importance of preserved fruits and juices lies mainly in their mineral and vitamin offerings. The problem was to find how much mineral and vitamin benefit each processed food provided per ration point of expenditure. Results showed, for example, that dried apricots at eight points was a far better buy than either prunes at twenty points or sauerkraut at four points.

INSTEAD of denoting the quantity or percentage of each nutritional factor present in each food, the table gives its *Nutritional Rating*. The Nutritional Rating is the percentage of one day's requirement of an eighteen year old boy provided by a pound of the given food. Dividing this percentage by the number of points one has to pay for a pound of the given food, gives the figure for the next column, the *Nutritional Benefit Per Point*. For example, referring to the table, a pound of sauerkraut furnishes 99% of a day's iron requirement. Dividing by four (the ration point price) gives 25, its Nutritional Benefit Per Point for iron.

Expanding this chart and keeping it up to date with changes which undoubtedly will be made from time to time in point values and in rationed items of food, should provide a fascinating project for a science class or

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FOOD VALUES AND RATION POINT VALUES*

	Ration Points Per Pound	CALCIUM		IRON		VIT. A		VIT. B		VIT. C		VIT. G	
		Nutritional Rating	Nutritional Benefit Per Point	Nutritional Rating	Nutritional Benefit Per Point	Nutritional Rating	Nutritional Benefit Per Point	Nutritional Rating	Nutritional Benefit Per Point	Nutritional Rating	Nutritional Benefit Per Point	Nutritional Rating	Nutritional Benefit Per Point
FRUITS & FRUIT JUICES (Canned and Bottled)													
Apples	8	2	.3	11	1	5	.6	9	1	36	4		
Applesause	8	2	.2	7	.8	4	.5	4	.6	16	2		
Apricots	13	4	.3	16	1	170	13	1	.1	10	.8	0	0
Cranberries	11	4	.4	13	1	1	.1	0	0	50	4	0	0
Cranberry Sauce	11	5	.5	12	1	1	.1	0	0	32	3	0	0
Grapefruit	8	7	.9	10	1	2	.2	17	2	200	25	9	1
Grapefruit Juice	8	57	7	8	1	1	.8	20	2	50	6	7	.8
Grape Juice	8	4	.4	9	1	3	.4	11	1	35	4	2	.3
Huckleberries (Blueberries)	11	8	.7	27	2	4	.3	10	.9	30	3	2	.2
Orange Juice	8	8	1	12	1	17	2	25	3	243	30	9	1
Peaches (yellow)	11	3	3	10	.9	120	11	10	9	37	3	7	6
Peaches (white)	11	3	3	10	.9	4	.3	10	9	37	3	7	6
Pears	11	4	.4	8	.8	1	.1	12	1	16	1	11	1
Pineapple	13	2	.1	9	.7	2	.1	14	1	45	3	4	.3
Pineapple Juice	11	3	.3	—	—	4	.3	17	1	30	3	4	.4
FROZEN FRUITS													
Cherries	13	6	.5	12	.9			91	.9	41	3		
Peaches (yellow)	13	3	.2	9	.7	112	9	11	.8	38	3	7	.5
Strawberries	13	11	.8	20	1	6	.4	6	.4	93	7		
DRIED FRUITS & VEG.													
Apricots	8	31	3	228	28	750	94	20	2	32	4	40	5
Beans, Navy	4	45	11	313	8	2	.6	90	22	0	0		
Peas	4	25	6	158	40	52	13	100	24			47	6
Soybeans	8	74	9	200	25	7	.9	270	34			133	17
VEG. & VEG. JUICES													
Asparagus	11	6	.5	27	2	33	3	20	2	100	9		
Beans, Fresh Lima	13	9	.7	72	5			68	5	112	9	34	3
Beans, Baked, without Pork	11	20	2	58	5	4	.4	30	3	0	0		
Beans, String or Snap	11	17	1	33	3	83	8	16	1	63	6	15	1
Carrots	11	14	1	17	1	217	20	21	2	15	1	14	1
Corn, Golden Bantam	11	—	—	12	1	90	8	30	3	43	4		
Corn, Sweet	11	2	.2	12	1	0	0	22	2	27	2		
Peas	13	4	.3	35	3	20	2	50	4	27	2	21	2
Sauerkraut	4	12	3	99	25	2	.5	7	2	22	5		
Spinach	11	25	2	75	7	1500	136	28	2	144	13	48	4
Tomatoes	13	2	.2	13	1	62	5	20	1	85	6	7	.5
Tomato Juice	11	2	.2	12	1	63	6	20	2	100	9	7	.6
SOUPS													
Pea Soup	8	30	4	25	3	21	3	3	.4			18	2
Split Pea Soup	8	5	.6	28	3	3	.3	20	2			8	1

* Ration values corrected as of March 12, 1943.

"Chem-Teaching" Tips

CARROL C. HALL

Springfield High School Springfield, Illinois

BOOKS in the lecture room. Do you have some old texts, some pamphlets, some old lab guides? Leave them on a convenient table in the lecture room. Let's give that natural curiosity in our students a chance. They'll look them over!

* * *

THE SIXTY-MINUTE PERIOD. Most of us are on that schedule. During a lecture or class-room period change the type of activity or give a break in the hour at least three times. Don't make the chem period a drag.

* * *

For your DEMONSTRATION. Have you outlined the equations, the procedures, etc., on the blackboard behind you? If not — then do so. Don't depend on your memory for everything. You may miss an important point.

* * *

Is your BLACKBOARD a dingy gray? Then use yellow chalk. It shows up better. Give the students the break.

* * *

More BLACKBOARD Tips. If you have some green chalk put some of it on an eraser and smear evenly over the board. You'll be surprised how much better the writing (in white or yellow chalk) stands out.

* * *

We are not all ARTISTS. But we can take time to make our blackboard illustrations better. Think over the job and make some improvements.

* * *

Take a *TIP* from the newer texts. Use two colors in writing equations on the board. Emphasize the *new* idea you're showing.

* * *

A BROWSING PERIOD. What's your hurry? Chemistry wasn't learned until many thousand years of human history had passed. Take time out for an occasional browsing period in the room. Have available all sorts of chemical literature. Let the pupils look it over. As for yourself — take time out to read some new things yourself. Its a mutual job.

* * *

Your Bulletin Board. Is a silent teacher. Take advantage of it. Change at least once each week. Have something on it that will cause the class to look twice. Maybe they can make contributions, too!

* * *

Have you a FILE? For each unit that you teach a separate file in which you include news items, new wrinkles, ideas, test questions, new lab idea, etc., or is your file in your hat. If so, it won't mean much and things will get away from you.

* * *

The PERIODIC TABLE. Should hang at your right hand (not in some inaccessible corner of the lecture room). Refer to it constantly in your lectures and explanations. Do you teach anything about it? If not, then you are neglecting our most important tool. If the facts of Chemistry cannot be shown then can we call Chemistry a Science? By the way, have you a unit of work on the table? Questions about it, that really make the students know how to use it?

* * *

DEMONSTRATIONS. Are necessary and essential — but what kind of a job are you doing? Is the demonstration set up for you or the class? Sit on the other side of the table for a few minutes and look your handiwork over. Maybe you'll change your procedures.

* * *

CHEMICAL MAGIC is lots of fun and a good teaching tool. Don't save your tricks for open house only — color your class sessions occasionally with them.

* * *

ARGUE a little bit once in a while during the class sessions. It stimulates thinking. After all, science is an argument — think it over!

Training for the Teaching of Physics and Aeronautics

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Because of the acute shortage of teachers with even the minimum training necessary for the teaching of physics and aeronautics this short article summarizes some of the opportunities for additional training that do exist. It is presented to those of you whose training was primarily in the biological sciences and any other interested teachers who might with very little effort become capable of "adopting" the physical sciences, at least for the duration, as a teaching field.

Since the writer is most familiar with the State University of Iowa the specific information which follows concerns this school. The reader should understand that almost any university offers similar work and that the function of this article is to direct attention to the course offerings of universities in general.

ALL colleges and universities offer summer school courses in elementary college physics. The tuition for these courses is usually very reasonable. It is possible, in most cases, for a teacher to earn eight semester hours of credit in physics during an eight week summer session. In the summer of 1942, the Physics Department at Iowa sent letters to all the high schools of the state describing certain additional courses for the people who were already teaching physics. The first two paragraphs of this letter follow.

"To the Teacher of High School Physics:

You and I are teaching physics in a new environment. Our students are interested in airplanes and jeeps and tanks; they are reviving interest in radio experimentation and are asking questions about ultra high frequencies in locating ships and planes. The army and navy have asked for greater emphasis on mathematics and physical sciences.

There is so great a demand for students who know something of electronics, the use of vacuum tubes in radio and other important devices, that we have been asked to supply students with certificates of preparation in electronics, to be presented upon enlistment. This will lead to assignment in the Signal Corps, for example, and thus produce an opportunity for more effectiveness. It would likewise be advantageous to the war effort if every high school physics teacher would give his students the benefit of additional training."

A standard catalog type course description followed for a course in Electronics and a course called "Physics in Wartime."

THE eighteen universities named in the following list are offering the E.S.M.W.T.* Physics Course for Secondary School Teachers.

University of Alabama, University of Arkansas, University of California, University of Chicago, University of Florida, Indiana University, State University of Iowa, University of Kansas, Louisiana State University, University of Minnesota, University of Nebraska, University of North Carolina, Oregon State College, Pennsylvania State College, University of Tennessee, University of Texas, University of Utah, University of Wisconsin.

The three following paragraphs are taken from the folder which describes the course and include adequate information.

"Men, and especially women, already educated for teaching in other fields — home economics, agriculture, the biological sciences, for example — can without excessive additional training teach high-school physics and mathematics. Former teachers, particularly women who have married, and persons in non-teaching positions but with some edu-

(Continued on Page Forty-Four)

* (Engineering, Science and Management War Training) Federal Security Agency, U. S. Office of Education.

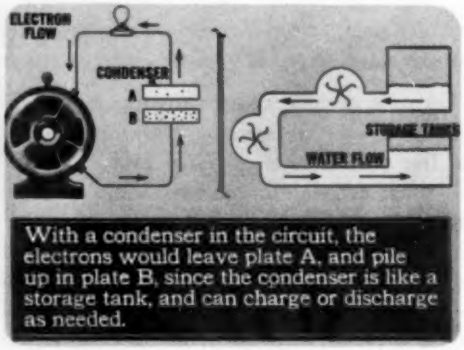
War Training Pictures Useful in Routine Class Work

LYNE S. METCALFE

THE broad program of education in skills and science related to the war effort, has made available an increasing number of motion pictures and slidefilms which are of direct or indirect use to the science instructor in routine classwork. This is particularly true in the field of aeronautics, one of the principal courses in the PIT (pre-induction training) Program of the High school Victory Organization, and in the pre-flight training activities conducted by schools and colleges.

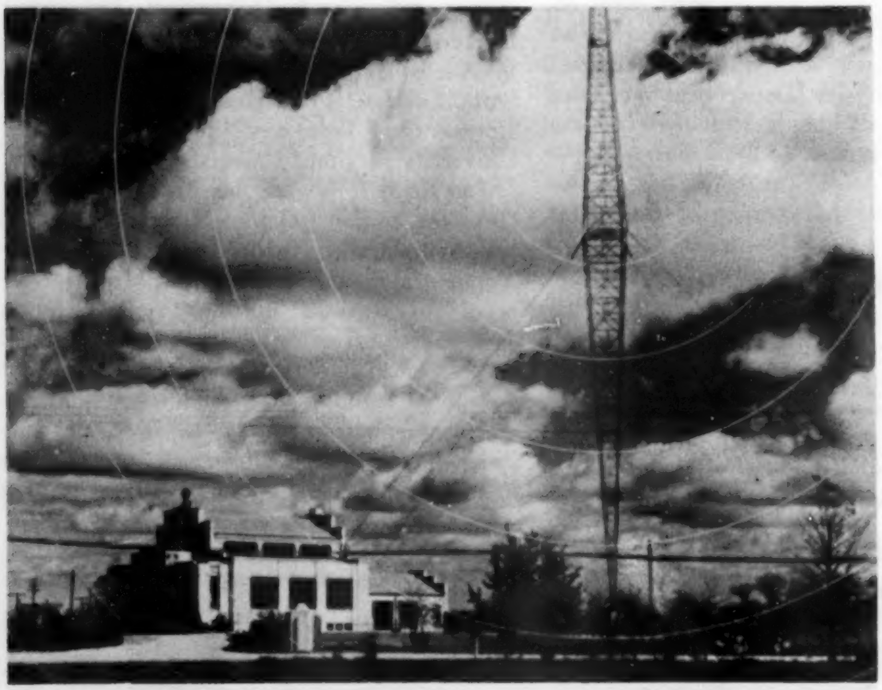
The importance of the picture screen in these basic training activities is indicated by the large and growing number of films already in use, produced both by the national government and by private agencies, and which, to a great extent, involve elementary instruction in many of the applied sciences. Because science teachers have quite naturally taken a leading part in conducting these courses, it has been recognized that the new motion pictures and slidefilms now placed at their disposal have a utility that goes beyond the range of the war training program itself.

Some examples may be cited. The five original course outlines, prepared by the U. S. Army, and Office of Education, and based upon technical manuals of the Army are: (a) fundamentals of radio, (b) fundamentals of machines, (c) fundamentals of electricity (d) fundamentals of auto-mechanics, and (e) fundamentals of shop work.



From a new slide film series on electricity. Copyright, Jam Handy Picture Service.

TO aid in the teaching of these subjects, approved slidefilm kit-sets have already been provided on all but radio. In order to ease the labors and to save the time of the in-



Putting the program on the air.

Learning through the eye is most effective. Copyright, Jam Handy Picture Service.

dividual science teacher in correlating the slidefilms with official course outlines, correlations have been made by qualified educators, using available and approved series of films in each catagory. That on electricity, for instance is now in the hands of instructors, and by using it as a guide, they can see at a glance just where each slidefilm sequence or subject fits into the approved course.

An available kit set on the basic electricity for instance, has over 1500 individual pictures — photographs, drawings, charts, diagrams and exhibits. There are a number of separate slidefilm subjects each covering one phase of the principles of electricity, many of which are of the kind that lend themselves to use in science teaching in the broader sense. Inasmuch as each subject is a separate teaching entity, films may be used singly in science classes where the subject being taught is suited to its use. For instance, there are subjects on electro-magnetism, magnetism, alternating current, electric cell, static electricity, and so on .

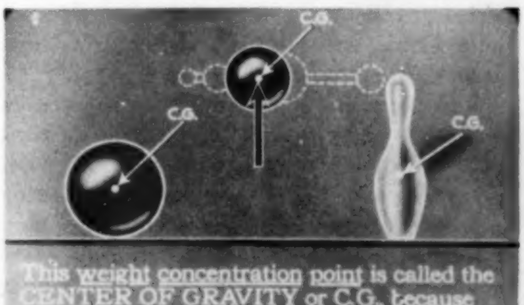
Using these films as a basis, the science teacher may prepare class material for elaboration, and enjoy the added benefits of visualization without making a long, and sometimes fruitless search for pictures of the kind wanted.

In the field of pre-flight aeronautics, one kit-set comprises 24 separate slidefilm productions and a total of over 1700 individual pictures — photographs, diagrams, cross-sections, charts and exhibits. Among the subjects in this series of special interest to the science instructor may be mentioned those on stability, the air ocean, air masses, weather, wing forces, lift and drag.

ONE series of pre-flight training slidefilms are based upon the official ground school material of the Civilian Pilot Training Program, checked and approved by the Civilian Pilot Training Service of the Civil Aeronautics Administration. They are being used by science instructors in thousands of schools and colleges to help make youth air-minded, and to more adequately give students the basic principles of flying prior to induction into the air services.

(Continued on Page Thirty-Nine)

Many pre-induction training films fit into regular science courses. Copyright, Jam Handy Picture Service.



IMPORTANCE OF INSECTS

(Continued from Page Fifteen)

Commission in Cuba, by revealing for the first time that all cases of this disease are caused by the bites of mosquitoes infected with the virus, made it possible to practically erase this disease from the American continent, by destroying the mosquitoes, and preventing them from biting persons ill of the disease. However a reservoir of the disease remains in the jungles of South America and Western Africa, where it is harbored in the bodies of monkeys and spread from monkey to monkey and to any human travelers who venture into the jungle by the bites of at least a dozen different kinds of mosquitoes. The worst disseminator of the disease in the jungle areas is a species of mosquito that breeds extensively in water held by tree holes and the angles of leaves in tree tops high above the jungle floor.

ALTHOUGH the disease has been driven out of most civilized areas of the world, the yellow fever mosquito is still present even in our own Southern States as far north as southern Illinois, and in many parts of Central and South America. It is also well established in Hawaii, Australia, the Mediterranean countries, India and the Far East, all countries where yellow fever has never flourished, solely because the virus which causes the disease has never been taken there. Mosquitoes can get the disease from sick persons only by biting them during the first 3 or 4 days after they become ill. Until the advent of airplane travel, it was impossible for any sick person to travel from West Africa or other center of infection to Europe, India, China, Australia, or the Pacific Islands in so short a time.

With the tremendous airplane activity over nearly all parts of the world at the present time, one of the gravest threats in the medical world today is that an incipient case of yellow fever or an infective mosquito may be transported from Africa or South America to the Mediterranean area, to India, China or Australia, where teeming millions of very susceptible human beings live and where the major carrier of the disease, the tiger mosquito, also occurs but has never become infected with the disease. The domestic habits of this particular mosquito of living mostly in houses, ships and trains, and its custom of hiding in clothing and crawling into human baggage, make it especially well adapted to be carried long distances in airplanes. It has been shown experimentally that this mosquito can survive for at least 6½ days in an airplane during which it traveled over 9,500 miles. The United States is by no means free from such danger, with our vastly increased communication with the South American jungles in search of rubber, insecticide plants, etc., because the tiger mosquito continues to breed in many places in our Southern States and needs only the introduction of the yellow fever virus to start an epidemic.

THAT these dangers are real and not merely hypothetical is emphatically demonstrated by the transfer from West Africa to Brazil of the Gambian mosquito, the most dangerous carrier of malaria in the entire family of malarial carriers. Until 1930 this mosquito was not known to occur in the Western Hemisphere. It was undoubtedly transported to Brazil in airplanes of the French air lines and started a widespread and devastating malaria epidemic. As a malaria carrier it is much more efficient than any of the Anopheles mosquitoes native to the Western hemisphere. Over 12,000 square miles of northeastern Brazil became involved; more than 2,000,000 dollars were spent and an army of over 2,000 trained workers was employed under the leadership of the Rockefeller Foundation to prevent further spread of the mosquito and to practically eradicate it from the Western Hemisphere. Apparently the war against this invader has been won. But with the increased frequency of airplane traffic across the South Atlantic the danger of new invasions by this and other terrible disease carriers from Africa presents a constant menace. All commercial planes are now carefully fumigated before they leave Africa and again before they discharge passengers and unload their baggage in Brazil. Dead gambian mosquitoes, killed by these fumigations have several times been discovered in planes arriving in Brazil. The gravest

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VITAMINS

(Continued from Page Seventeen)

ANALYSIS of the active carotenoids starts with saponification and extraction. Then the analyst uses the discovery of Willstater and Stoll that a solution of 90 percent methyl alcohol removes most of the interfering materials and leaves the desired carotenoids behind. These are purified and the solution concentrated to the desired point. The short method for carotenoids reads this solution colorimetrically Results are usually 10 to 40 percent too high due to color from inactive materials. Further separations are carried out by chromatographic means. Some people claim that this is an art rather than a science. I am willing to agree that they are correct in many cases but the type of separations run in this laboratory are fairly well standardized.

The tube used is illustrated at A in Figure 1. It is a glass tube with a cotton plug at the bottom. The tube is packed with $MgCO_3$. Although it doesn't show in a black and white picture, there is a light yellow band at the top and a darker one at the bottom. The solvent, Skelly solve B, will wash the dark band of beta carotene on through while the top band of impurities remains on the column. If corn had been used there would be an intermediate band of cryptoxanthin that would wash through, but at a slower rate than the beta carotene. Each fraction is separated, made up to volume, and read in a colorimeter.

None of the other fat soluble vitamins has been determined satisfactorily by chemical means. Some methods have been proposed but none has been generally accepted.

THE first water soluble vitamin to be determined satisfactorily was vitamin C, known to the chemist as ascorbic acid. This compound is a reducing agent. Many dies are colored in their oxidized form and colorless in the reduced form. Measuring the amount of dye that is made colorless is a measurement of the ascorbic acid present. The dye that is used is 2,6-dichlorophenol-indophenol. Since we want a water solution, the sodium salt is used.

Difficulties? Of course. A dye that will be reduced by ascorbic acid will also be reduced by other materials. Conditions for the titration are chosen to make it as specific for ascorbic acid as possible. In the presence of 5 percent metaphosphoric acid, ascorbic acid will react quickly while most other naturally occurring reducing materials react more slowly. We set a 30-second time limit for the pink color to persist. some extracts are too highly colored to titrate visually. Special techniques for each individual material must be worked out. There are photoelectric colorimetric methods and measurements of the oxidation-reduction potentials to use for these tests. The visual titration seems to be most satisfactory when it can be used.

There are two members of the "B" vitamin group which are often determined chemically. These are B_1, or thiamin, and riboflavin. Thiochrome, an oxidized form of thiamin, and riboflavin have the property of fluorescing when placed in a beam of light from a mercury lamp.

Conner and Straub published a procedure for the combined determination of the two vitamins. Extraction is carried out by autoclaving the material with dilute acid. The acidity is adjusted and an enzyme that acts on starch is added. Our procedure varies here in that we also add an enzyme, papain, that acts on protein. These two enzymes break up the natural combinations of the vitamins with other materials.

AFTER filtration a suitable aliquot is placed in a tube such as that illustrated as B in Figure 1. This tube is packed with a material known as Decalso. Thiamin is absorbed on the column and riboflavin passes through. The thiamin is eluted by a solution of KCl in 2 percent acetic acid. When this solution is treated in strong alkali with potassium ferricyanide, the thiamin is oxidized to thiochrome. Thiochrome fluoresces quantitatively when excited with light from a mercury lamp. Using proper filters to screen out the extra light, it is possible to measure this fluorescence to an accuracy equivalent to .0000001 gram of thiamin.

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MINERALS IN WAR

(Continued from Page Nine)

Tennessee. Mexico and Canada are also important sources of these metals.

As in peacetime, tin is used chiefly for making tin cans (actually made from sheet iron plated with a thin coating of tin). Since large quantities of food must be shipped to distant places, tin cans are even more important in war than peace.

OUR domestic tin production is small; only in Alaska are there any deposits which may eventually give us a supply of our own. The world's greatest tin deposits are in the Malay Peninsula, Siam, and Burma, and thus constitute one of the rich prizes won by the Japanese in their occupation of most of this region.

Fortunately, the loss of the Asiatic deposits need not cause a tin shortage in the United States. There remains open to us the rich mines of Bolivia, second richest tin producing area in the world. Great Britian also has rich tin deposits — those of Cornwall, which have been worked since the time of the Phoenicians, in 1000 B. C.

Summary

A SURVEY of the mineral needs of the United States shows that mechanized war demands enormous supplies of oil and iron. This country possesses these, as well as adequate amounts of most other necessary minerals. Two knotty problems confront us, however:

(1) To see that our allies receive much needed minerals possessed by us (or manufactured goods based upon these minerals).

(2) To procure for ourselves an adequate supply of the ferro-alloy minerals for the manufacture of great quantities of alloy steel for armaments.

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WAR TRAINING PICTURES

(Continued from Page Thirty-three)

Supplementary slidefilm series in this program are, aircraft mechanics, aircraft engine mechanics, aviation metalsmiths, and oxy-acetylene welding. Each of these areas are broken down into a number of subjects which in turn are well illustrated with pictures.

By no means are all of these subjects of direct interest to the science instructor beyond the field of their original purpose — preliminary war time training — but in nearly every series will be found slidefilms which may be logically used in science classes generally.

The supply of motion pictures directly integrated with elementary war-training activities in the schools is now large and on the increase. Many of them supplement or augment the slidefilms now available.

OF course, none of these pictures are expected to do more than save the time of the instructor in establishing fundamental principles in science, and in speeding up the preliminary stages of the study. This leaves the instructor more time for discussion, demonstration and detail study at a time when the science teacher carries so many newly added burdens, the result of war time conditions.

Slidefilms being used in these courses are of the reading or discussional type. That is, they are a strip of 35 mm. safety motion picture film with explanatory text, labels, letterings, legends or notations superimposed on the film. The specific purpose of this type of film is to permit the instructor to read and speak without interference, and to permit the students to talk, if desired, providing illustrated material in illuminated form for class participation, and to encourage discussion. Practically all films being used in the current school and college war-time educational activities are suited to serve similar ends in the post-war era, with the result that there is now being built up a large reservoir of pictured material of special interest and value to the science teacher of the future as well as the present.

VITAMINS

(Continued from Page Thirty-six)

The filtrate from the Delasco column is passed through a second column, C in Figure 1, packed with Supersorb. The riboflavin is absorbed and, unfortunately, some interfering materials. Gentle suction is often necessary, as illustrated, to pull the liquid through. The riboflavin is eluted with a 20 percent pyridine solution. Treatment with permanganate and hydrogen peroxide removes the interfering materials and riboflavin fluorescence is measured in the photofluorometer. Riboflavin fluoresces with a different wave length than thiochrome, and requires a different set of filters. The fluorescence is not as intense as that of thiochrome being about one-fifth as strong. This, plus the fact that the microbiological method has been quite successful, has prevented the general adoption of the method. The use of an unpleasant material like pyridine does not enhance the popularity of any method.

THERE are a number of other vitamins that are needed by man or animals. Some laboratories have published chemical methods but none are in general use. One of the most tantalizing cases is that of nicotonic acid. The requirements are high, it is widely distributed, and we have several good color reactions. In the presence of cyanogen bromide it forms a color with aromatic amines. The difficulty is that no material such as Decalsco or Supersorb has been found that will remove nicotonic acid from interfering colors. Some laboratories have reported the use of special charcoals, Lloyd's reagent, or various other materials to remove excess color but none have been generally accepted.

SUMMARY

A BRIEF description of chemical methods for the determination of several vitamins has been presented. These methods may be listed as follows:

(1) Vitamin A may be determined colorimetrically by the Carr-Price reaction or directly by means of a spectrophotometer or spectrograph.

(2) Active carotenoid pigments can be separated by chromatographic methods and determined colorimetrically.

(3) Ascorbic acid can be determined by an ordinary titration method using 2,6-dichlorophenolindophenol.

(4) Thiamin and riboflavin can be absorbed on Delasco and Supersorb respectively, eluted, and determined using a photofluorometer. Thiamin must be converted to the fluorescing compound thiochrome for this determination.

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JUNIOR ACADEMY

(Continued from Page Twenty-six)

region include taping the legs and abdomen, wearing a broad tightly buckled belt, and inflatable belt to produce pressure on the abdomen which is helpful but uncomfortable; also wearing a water suit in which the pilot is surrounded by liquid so that during accelerations the fluid presses equally on the body in all directions.

Another phenomenon caused by the sense organs is airsickness, a close cousin of seasickness. It is caused by "bumpy" air, spaces containing ascending and descending air currents, and as yet is not very well understood.

The tendencies to this disease vary with individuals; however the first symptoms are usually felt in the digestive tract with slight nausea which gradually becomes worse. Next the face changes in color, varying from a yellowish to greenish gray while the victim breaks out in a cold sweat and has a "don't care" attitude.

Preventions also vary. Avoidance of bad odors, worries, fears, an empty stomach, and indigestion help as also do concentration on writing, reading, or something requiring manual skill. There is no specific medicine to cure this disease. Most remedies contain sedatives which produce varied effects and are not recommended.

These are the problems man has already met and partially coped with, but there are many others yet to be solved. What will man do in the future? How is man to prevent the transportation of insect pests and plant diseases between continents? Since there is already a great deal of global travel and after the war there is bound to be more, how is man to prevent the spread of human diseases?

Nowadays, we, as the adults of tomorrow, must change our thinking to meet the new conditions that a growing mastery of the air has brought to the world.

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Biology of Flight — Fitzpatrick and Stiles
Fit to Fly — Grow
Youth Must Fly — McDonald.

RATION POINTS

(Continued from Page Twenty-eight)

a science club. It would be interesting for the students to prepare these in the form of wall charts. Printing the benefit per point column in red would facilitate ready reference. Students will learn much not only in working out values for additional foods, but also in analyzing the results in reference to dietary needs.

An extensive chart of this nature can serve two practical purposes. One is the comparison of relative Nutritional Benefit Per Point values, as I have pointed out. The Nutritional Rating columns are more serviceable for use in studying nutrient values of foods than are tables which give actual quantities of each factor present in a given weight of each food. Charts which give values in milligrams, micrograms and international units do not lend themselves readily to study and to comparisons among the nutritional factors of different foods.

THE chart shows not only the outstanding nutritional value of soybeans, but also their high benefit per point. (Incidentally, this is a food high in other nutritional factors not treated here. It is a good buy for the money and for the points paid.) Note the poor value of grapejuice, and compare it with the high value of orange juice, both at eight points from your ration book. Compare the values of dried peas and canned peas. The fact that the former lacks vitamin C may not be very serious if this factor is supplied by unrationed fruits. Moreover, the vitamin may be restored to a significant extent by soaking and then germinating the peas for two or three days before use.

It is interesting to note that the ration value of sauerkraut, which is low in point price, lies mainly in its iron content. There are other rationed foods in this chart which also provide excellent iron sources while, at the same time, giving excellent values in other important factors. In making practical application of this chart, consideration should be given to the nutritional values of unrationed foods eaten by the children. For example, a quart of milk, or its equivalent,

supplies the daily calcium requirement and two thirds of the vitamin G need.

I SHOULD consider it quite worthwhile to allot additional teaching time to a study of nutrition in rationing. You will be rendering a patriotic service to our nation; and the children will be learning something worthwhile about their food needs. There is every indication that, by the time this article comes off the press, other classes of food will enter the rationing system. For some of these, protein evaluation will be important, for others fuel evaluation. Then again, some foods are valuable in more than one of these areas. Pupils who participate in constructing such charts and revising them from time to time, as rationing is revised, will acquire a working knowledge of valuable information about food values.

Joseph Singerman
March 7, 1943

MANPOWER PROGRAM

(Continued from Page Ten)

Both industry and the armed forces need a continuous supply of trained scientific and technical workers. These require a long period of training which is best begun in high school.

SO IN THE interest of an all out war effort that takes into account the future and possible long term struggle, science teachers should see to it that the most capable students are encouraged to include as much science and mathematics as possible among their courses. Physics, chemistry, and biology — all are vital. There is no short cut in learning science principles.

In the high school the likely increase in science enrollment the coming year brings with it the responsibility for giving these students practical and functional courses. Already this year much has been accomplished through special science work, and through new pre-training courses. Much new material has become available from publishing companies and from government sources. It is our job to make use of it. We have a job to do in teaching science, an important and vital one; let's get it done.

—John C. Chiddix

PHYSICS AND AERONAUTICS

(Continued from Page Thirty-one)

cation and competence in the roughly related fields in many cases also can become instructors after an accelerated program of home study.

Anyone wishing to take these courses must fulfill the following requirements:

(1) Have completed high-school or college courses in
   (a) Algebra and geometry (*for mathematics*).
   (b) Algebra, geometry, and one science (*for physics*).

(2) Obtain a statement from a responsible school official that the applicant is now employed as a teacher of mathematics or physics, or that he or she will have reasonable opportunity for such employment upon the completion of the course.

Each institution offering these correspondence courses retains the right to accept or reject applications on the basis or other selective criteria.

There is no tuition charge to the student and no fees are required, except that every student will be expected to purchase his own textbooks."

FOR the teaching of aeronautics it may be more difficult to obtain training. However, the following material which has been sent to the schools of Iowa is evidence that the Universities are doing their part in making the training available.

"Because of the increasing demand for courses in Aeronautics in high schools, the University of Iowa is offering a summer session course in Aeronautics under the Civil Aeronautics Administration. The course will begin June 7th and end July 31st, and will carry three semester hours credit. The course will include all of the Ground School subjects which are pertinent to a high school teaching program. These subjects are Navigation, Meteorology, Civil Air Regulations, Operation of Aircraft, Principles of Flight, et cetera.

In order to enroll in this course, it is necessary that the applicant present a letter from his principal or superintendent indicating that the applicant will, in all probability, teach a course in Aeronautics in the high school in question during the next academic year.

This course is offered by the University to summer school students in order to assist them in obtaining a well-rounded summer school program. The course in Aviation is recognized as partly fulfulling the requirement in Science. All those interested may obtain more complete information from Huber O. Croft, Coordinator, War Training Service, Civil Aeronautics Administration, 122 Engineering Building, University of Iowa, Iowa City, Iowa."

It may not be perfectly clear from the above quotation that the letter from the principal or superintendent removes the necessity for paying tuition for the Aeronautics course.

Some readers may know of other courses that are available which have not been mentioned. Each of us should assume responsibility for keeping our fellow teachers informed.

BOOK SHELF

HANDBOOK OF MICROSCOPIC CHARACTERISTICS OF TISSUES AND ORGANS, 2nd EDITION, Stiles and Bailey. 204 pages. Blakiston, 1943. $1.50

THIS handbook has so proven its worth that it now has compelled its publishers to issue a second edition. Briefly, it is an outline of a course which normally takes a volume of 700 pages or more to cover. This note-book type of text presents each tissue and organ in the body with its most important characteristics for identification purposes. Indeed it will prove to be a time saver for histology students. Thus you will find not only the entire course in Histology outlined but, in addition, summary tables and plenty of blank pages (about 50%), useful for notes and drawings.

—Frank Skutelsky, Christopher Columbus High School, N. Y. C.

MATHEMATICS FOR PILOTS. McGraw-Hill Book Company, New York City, 1943. 157 pp. $ .75 list.

As the first of a series of twelve books for training in aviation, the book provides a review of the fundamental operations in arithmetic and algebra. A chapter each is given to angular measurement, variation, and graphs. Many of the practical problems are in terms of military situations. The book offers a good short practical review course.

AIR NAVIGATION. McGraw-Hill Book Company, New York City, 1943. Part I, 79 pp.; 98 illus.; part II, 81 pp., 405 illus. Each volume, $1.00 list.

Air Navigation — Part I and Part II — are the first two volumes of a seven volume series in this area. All are published under the supervision of the Training Division, Bureau of Aeronautics, U. S. Navy. Part I deals with "Orientation to Earth" and is prepared for orienting naval aviation cadets to navigation that may be anywhere on the earth's surface. It gives a view of the earth as a sphere with place relationships of war zones, general climatic considerations underlying strategy, and something of strategic significance of military objectives. Part II gives a detailed explanation of various types of map projections and the location of places on the earth's surface. It also includes the construction and use of plotting sheets and the reading of maps in terms of exact location in navigation.

FUNDAMENTALS OF MACHINES. Charles E. Dull, Senior High School, Newark, N. J. and Ira G. Newlin, Scarsdale High School, Scarsdale, N. Y. Henry Holt and Co., N. Y., 1943. 547 pp., illus. List $1.32.

In *Fundamentals of Machines* is presented a one-semester course for high school juniors and seniors, developed in conformity with course PIT - 102 of the War Department. It is amplified to give slower students an opportunity to grasp the fundamentals of machines as well as for the more able students. Along with a study of the theory of machines and their types is given a study of energy and its use. The last section illustrates the principles studied in terms of the automobile. Nineteen laboratory experiments are also included.

ELEMENTS OF RADIO. Abraham Marcus and William Marcus. Edited by Ralph E. Horton. Prentice-Hall, N. Y., 1943. 699 pp., 504 illus. List, one vol. $3.20, two vol. $1.96 each.

The book presents a one year course in the study of radio. It is divided into two parts, the first of which contains no technical formula and can easily be grasped by those who have some facility in the use of tools and in thinking in terms of mental pictures. At each level of learning the complete radio receiver is presented as a means of maintaining interest, starting with the simplest form of receiver, the crystal set. Explanations are quite clear and many illustrations are used. A rather complete program of classroom demonstrations are included.

THE AMATEUR SCIENTIST. W. Stephen Thomas. W. W. Norton and Co., N. Y., 1942. 291 pp., illus.

Discusses science as a hobby, the work of the amateur scientist, and organizations of amateur scientists.

WONDERS TO SEE. Lillian Hethershaw, formerly Head of General Science Department, Drake University and Tunis Baker, Department of Science, State Teachers College, Pattrson, N. J. World Book Co., Yonkers-on-Hudson, N. Y. 1942. 284 pp., illus.

One of a series of textbooks for the intermediate grades. It includes a simple study of seeds, animals in winter, magnets, the sky, bees, and birds.

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1. EARTH, MOON AND PLANETS. Whipple, 293 pages. 2. THE MILKY WAY. Bok and Bok, 204 pages. 3. THE STORY OF VARIABLE STARS. Campbell and Jacchia. 226 pages. The Blakiston Co., Philadelphia, 1943. Each $2.50 list.

Latest discoveries in astronomy are ably set forth in these attractive additions to the Harvard Books on Astronomy, edited by Harlow Shapley and Bart J. Bok. The popular

style used in treating these fascinating subjects is appealing to the mature student and to the layman with a curiosity about the heavens. The books are well illustrated with excellent drawings and some of the finest telescopic photographs. An interesting feature of *Earth, Moon and Planets* is the Planet Finder which enables the reader to locate directly the planets in the sky at any time from the present through 1970. *The Milky Way* includes protraits of the leading scientists in the field.

IMPORTANCE OF INSECTS

(Continued from Page Thirty-four)

danger is that the pressure of the war effort may force the discontinuance of these fumigating precautions and that military necessity may override the interests of public health.

Another threat to the Western hemisphere was revealed by the discovery of the tse-tse fly on a plane headed for Brazil from Africa in November, 1941. The tse-tse flies are the essential carriers of true human sleeping sickness and a whole complex of animal diseases caused by the blood parasited called trypanosomes which, more than anything else, have retarded the civilization of Central Africa for centuries, and made of it the Dark Continent.

That these flies probably can live in North and South America, as well as in Africa, is attested by the fact that fossil remains of tse-tse flies have been found in this country. It fact it is believed that a tse-tse fly-borne disease of animals was probably responsible for the extermination of the horse from the western hemisphere in prehistoric times.

(Continued in October Issue)